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(54) Title: HARD SURFACE CLEANING AND DISINFECTING COMPOSITIONS

(57) Abstract: Hard surface cleaning and disinfecting compositions comprise a synergistic combination of a cationic surfactant having germicidal properties and a tristyrylphenolalkoxylate compound. The hard surface cleaning and disinfecting compositions provide excellent cleaning and disinfection of hard surfaces.

**WO 03/091373 A1**

## Hard Surface Cleaning and Disinfecting Compositions

The present invention relates to hard surface cleaning and disinfecting compositions which comprise a  
5 synergistic combination of a quaternary ammonium compound and a tristyrylphenolalkoxylate compound.

The prior art has suggested many aqueous compositions which are directed to provide a cleaning or disinfecting benefit to such hard surfaces. These  
10 compositions predominantly are aqueous preparations which include one or more deterative surfactants, one or more organic solvents and in minor amounts, conventional additives included enhance the attractiveness of the product, typically fragrances and coloring agents.  
15 Certain of these also include one or more constituents which provide a primary disinfecting benefit to the aqueous preparations.

While these known-art compositions may provide advantages, there is a continuing need in the art for  
20 such hard surface treatment compositions which include reduced amounts of active constituents, and which minimize or eliminate the amounts of organic solvents which need be present in such compositions.

It is yet a further object of the invention to  
25 provide a readily pourable and readily pumpable cleaning composition which features the benefits described above.

It is a further object of the invention to provide a process for cleaning or sanitization of hard surfaces, which process comprises the step of: providing the  
30 composition as outlined above, and applying an effective amount to a hard surface requiring such treatment.

These and other objects of the invention shall be more apparent from a reading of the specification and of the claims attached.

The present invention provides a hard surface  
5 cleaning and disinfecting composition which comprises  
(preferably, consisting essentially of) the following  
constituents:

- (a) at least one cationic surfactant having  
germicidal properties;
- 10 (b) a tristyrylphenolalkoxylate compound, desirably  
one or more tristyrylphenolethoxylate  
compounds;
- (c) optionally, one or more deterative surfactants  
particularly selected from carboxylate,  
15 nonionic, cationic and amphoteric surfactants;
- (d) optionally, one or more organic solvents;
- (e) a major proportion of water.

The compositions described above may include one or  
more further conventional optional constituents such as:  
20 pH buffering agents, perfumes, perfume carriers,  
colorants, hydrotropes, germicides, fungicides, anti-  
oxidants, anti-corrosion agents, and the like.

Preferred compositions according to the invention  
are largely aqueous, and are readily pourable and  
25 pumpable when packaged from a manually operable pump,  
such as a 'trigger spray' dispenser. The preferred  
compositions of the invention feature good cleaning,  
disinfection of hard surfaces and little or not buildup  
of residue on treated hard surfaces.

30 According to a first aspect of the invention there  
is provided a hard surface cleaning and disinfecting

composition which comprises (preferably, consisting essentially of) the following constituents:

- (a) at least one cationic surfactant having germicidal properties;
- 5 (b) a tristyrylphenolalkoxylate compound, desirably one or more tristyrylphenolalkoxylate compounds;
- (c) one or more deterative surfactants particularly selected from carboxylate, nonionic, cationic and amphoteric surfactants;
- 10 (d) one or more organic solvents; and
- (e) water.

The compositions described above may include one or more further conventional optional constituents such as:

15 pH buffering agents, perfumes, perfume carriers, colorants, hydrotropes, germicides, fungicides, anti-oxidants, anti-corrosion agents, and the like.

Preferred compositions according to the invention are largely aqueous, and are readily pourable and pumpable when packaged from a manually operable pump,

20 such as a "trigger spray" dispenser. The preferred compositions of the invention feature good cleaning, disinfection of hard surfaces and little or no buildup of residue on treated hard surfaces.

25 According to a second aspect of the invention, there is provided a hard surface cleaning and disinfecting composition which comprises (preferably, consisting essentially of) the following constituents:

- 30 (a) at least one cationic surfactant having germicidal properties;

- (b) a tristyrylphenolalkoxylate compound, desirably one or more tristyrylphenolethoxylate compounds;
- (c) one or more deterative surfactants particularly selected from carboxylate, nonionic, cationic and amphoteric surfactants;
- (e) a major proportion of water;
- characterized in that the composition is essentially free of (d) one or more organic solvents, such as water soluble alcohols, ethers, and glycol ethers. These compositions may include one or more further conventional optional constituents such as: pH buffering agents, perfumes, perfume carriers, colorants, hydrotropes, germicides, fungicides, anti-oxidants, anti-corrosion agents, and the like.

According to a third aspect of the invention, there is provided a hard surface cleaning and disinfecting composition which comprises (preferably, consisting essentially of) the following constituents:

- (a) at least one cationic surfactant having germicidal properties;
- (b) a tristyrylphenolalkoxylate compound, desirably one or more tristyrylphenolethoxylate compounds;
- (d) one or more organic solvents;
- (e) a major proportion of water.

characterized in that the composition is essentially free of (c) one or more deterative surfactants particularly selected from carboxylate, nonionic, cationic and amphoteric surfactants;

The compositions may include one or more further conventional optional constituents such as: pH buffering agents, perfumes, perfume carriers, colorants, hydrotropes, germicides, fungicides, anti-oxidants, anti-corrosion agents, and the like.

In accordance with a fourth aspect of the invention there is provided a hard surface cleaning and disinfecting composition which comprises (preferably, consists essentially of) the following constituents:

10

- (a) at least one cationic surfactant having germicidal properties;
- (b) a tristyrylphenolalkoxylate compound, desirably one or more tristyrylphenolethoxylate compounds;
- (e) a major proportion of water;

15

wherein the compositions are essentially free of (c) deterative surfactants, particularly carboxylate, nonionic, cationic and amphoteric surfactants, as well as being essentially free of (d) organic solvents.

20

As used in this specification, the term "essentially free" is to be understood that the compositions comprise not more than 0.001%wt. of the indicated constituent, but preferably the compositions comprise 0%wt. of the indicated constituent.

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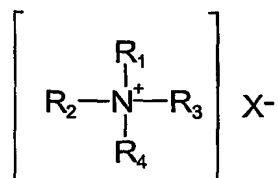
The compositions described above may include one or more further conventional optional constituents such as: pH buffering agents, perfumes, perfume carriers, colorants, hydrotropes, germicides, fungicides, anti-oxidants, anti-corrosion agents, and the like.

30

The inventive compositions necessarily include (a) at least one cationic surfactant having germicidal properties.

Particularly preferred for use as the (a) cationic surfactant having germicidal properties are those cationic surfactants which are found to provide a broad antibacterial or sanitizing function. Any cationic surfactant which satisfies these requirements may be used and are considered to be within the scope of the present invention, and mixtures of two or more cationic surface active agents, viz., cationic surfactants may also be used. Cationic surfactants are well known, and useful cationic surfactants may be one or more of those described for example in *McCutcheon's Functional Materials*, Vol.2, 1998; *Kirk-Othmer, Encyclopedia of Chemical Technology*, 4th Ed., Vol. 23, pp. 478-541 (1997), the contents of which are herein incorporated by reference. These are also described in the respective product specifications and literature available from the suppliers of these cationic surfactants.

Examples of preferred cationic surfactant compositions useful in the practice of the instant invention are those which provide a germicidal effect to the concentrate compositions, and especially preferred are quaternary ammonium compounds and salts thereof, which may be characterized by the general structural formula:



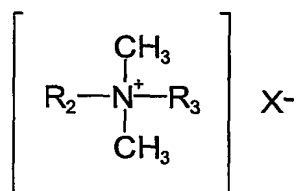
where at least one of  $R_1$ ,  $R_2$ ,  $R_3$  and  $R_4$  is a alkyl, aryl or alkylaryl substituent of from 6 to 26 carbon atoms, and the entire cation portion of the molecule has a molecular weight of at least 165. The alkyl substituents  
5 may be long-chain alkyl, long-chain alkoxyaryl, long-chain alkylaryl, halogen-substituted long-chain alkylaryl, long-chain alkylphenoxyalkyl, arylalkyl, etc. The remaining substituents on the nitrogen atoms other than the abovementioned alkyl substituents are  
10 hydrocarbons usually containing no more than 12 carbon atoms. The substituents  $R_1$ ,  $R_2$ ,  $R_3$  and  $R_4$  may be straight-chained or may be branched, but are preferably straight-chained, and may include one or more amide, ether or ester linkages. The counterion X may be any  
15 salt-forming anion which permits water solubility of the quaternary ammonium complex.

Exemplary quaternary ammonium salts within the above description include the alkyl ammonium halides such as cetyl trimethyl ammonium bromide, alkyl aryl ammonium  
20 halides such as octadecyl dimethyl benzyl ammonium bromide, N-alkyl pyridinium halides such as N-cetyl pyridinium bromide, and the like. Other suitable types of quaternary ammonium salts include those in which the molecule contains either amide, ether or ester linkages  
25 such as octyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride, N-(laurylcocoaminoformylmethyl)-pyridinium chloride, and the like. Other very effective types of quaternary ammonium compounds which are useful as germicides include those in which the hydrophobic  
30 radical is characterized by a substituted aromatic nucleus as in the case of lauryloxyphenyltrimethyl ammonium chloride, cetylaminophenyltrimethyl ammonium



methosulfate, dodecylphenyltrimethyl ammonium methosulfate, dodecylbenzyltrimethyl ammonium chloride, chlorinated dodecylbenzyltrimethyl ammonium chloride, and the like.

5 Preferred quaternary ammonium compounds which act as germicides and which are be found useful in the practice of the present invention include those which have the structural formula:



10

wherein  $\text{R}_2$  and  $\text{R}_3$  are the same or different  $\text{C}_8$ - $\text{C}_{12}$ alkyl, or  $\text{R}_2$  is  $\text{C}_{12}$ - $\text{C}_{16}$ alkyl,  $\text{C}_8$ - $\text{C}_{18}$ alkylethoxy,  $\text{C}_8$ - $\text{C}_{18}$ alkylphenoxyethoxy and  $\text{R}_3$  is benzyl, and  $\text{X}$  is a halide, for example chloride, bromide or iodide, or is a  
15 methosulfate anion. The alkyl groups recited in  $\text{R}_2$  and  $\text{R}_3$  may be straight-chained or branched, but are preferably substantially linear.

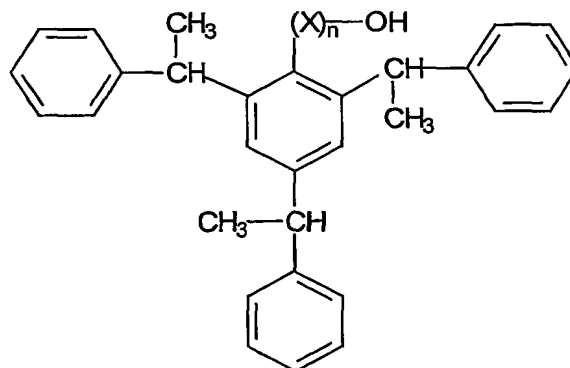
Particularly useful quaternary germicides include compositions which include a single quaternary compound,  
20 as well as mixtures of two or more different quaternary compounds. Such useful quaternary compounds are available under the BARDAC®, BARQUAT®, HYAMINE®, LONZABAC®, and ONYXIDE® trademarks, which are more fully described in, for example, *McCutcheon's Functional Materials* (Vol. 2),  
25 North American Edition, 1998, as well as the respective product literature from the suppliers identified below. For example, BARDAC® 205M is described to be a liquid containing alkyl dimethyl benzyl ammonium chloride, octyl decyl dimethyl ammonium chloride; didecyl dimethyl

ammonium chloride, and dioctyl dimethyl ammonium chloride (50% active) (also available as 80% active (BARDAC® 208M)); described generally in *McCutcheon's* as a combination of alkyl dimethyl benzyl ammonium chloride and dialkyl dimethyl ammonium chloride); BARDAC® 2050 is described to be a combination of octyl decyl dimethyl ammonium chloride/didecyl dimethyl ammonium chloride, and dioctyl dimethyl ammonium chloride (50% active) (also available as 80% active (BARDAC® 2080)); BARDAC® 2250 is described to be didecyl dimethyl ammonium chloride (50% active); BARDAC® LF (or BARDAC® LF-80), described as being based on dioctyl dimethyl ammonium chloride (BARQUAT® MB-50, MX-50, OJ-50 (each 50% liquid) and MB-80 or MX-80 (each 80% liquid) are each described as an alkyl dimethyl benzyl ammonium chloride; BARDAC® 4250 and BARQUAT® 4250Z (each 50% active) or BARQUAT® 4280 and BARQUAT® 4280Z (each 80% active) are each described as alkyl dimethyl benzyl ammonium chloride/alkyl dimethyl ethyl benzyl ammonium chloride. Also, HYAMINE® 1622, described as diisobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride (50% solution); HYAMINE® 3500 (50% actives), described as alkyl dimethyl benzyl ammonium chloride (also available as 80% active (HYAMINE® 3500-80)); and HYMAINE® 2389 described as being based on methyl dodecyl benzyl ammonium chloride and/or methyl dodecyl xylene-bis-trimethyl ammonium chloride. (BARDAC®, BARQUAT® and HYAMINE® are presently commercially available from Lonza, Inc., Fairlawn, New Jersey). BTC® 50 NF (or BTC® 65 NF) is described to be alkyl dimethyl benzyl ammonium chloride (50% active); BTC® 99 is described as didecyl dimethyl ammonium chloride (50% active); BTC® 776 is described to be

myrisalkonium chloride (50% active); BTC® 818 is described as being octyl decyl dimethyl ammonium chloride, didecyl dimethyl ammonium chloride, and dioctyl dimethyl ammonium chloride (50% active) (available also  
5 as 80% active (BTC® 818-80%)); BTC® 824 and BTC® 835 are each described as being of alkyl dimethyl benzyl ammonium chloride (each 50% active); BTC® 885 is described as a combination of BTC® 835 and BTC® 818 (50% active) (available also as 80% active (BTC® 888)); BTC® 1010 is  
10 described as didecyl dimethyl ammonium chloride (50% active) (also available as 80% active (BTC® 1010-80)); BTC® 2125 (or BTC® 2125 M) is described as alkyl dimethyl benzyl ammonium chloride and alkyl dimethyl ethylbenzyl ammonium chloride (each 50% active) (also available as  
15 80% active (BTC® 2125 80 or BTC® 2125 M)); BTC® 2565 is described as alkyl dimethyl benzyl ammonium chlorides (50% active) (also available as 80% active (BTC® 2568)); BTC® 8248 (or BTC® 8358) is described as alkyl dimethyl benzyl ammonium chloride (80% active) (also available as  
20 90% active (BTC® 8249)); ONYXIDE® 3300 is described as n-alkyl dimethyl benzyl ammonium saccharinate (95% active). (BTC® and ONYXIDE® are presently commercially available from Stepan Company, Northfield, Illinois.) Polymeric quaternary ammonium salts based on these monomeric  
25 structures are also considered desirable for the present invention. One example is POLYQUAT®, described as being a 2-butenyldimethyl ammonium chloride polymer. The cationic surfactant(s) may be present in any effective amount, but generally need not be present in  
30 amounts in excess of about 10%wt. based on the total weight of the composition. The preferred germicidal cationic surfactant(s) may be present in the concentrated

liquid disinfectant compositions in amounts of from about 0.001 % by weight to up to about 10% by weight, very preferably about 0.01-8% by weight, more preferably in amount of between 0.5-6 % by weight, and most preferably from 2 - 4% by weight. It is particularly advantageous that the preferred germicidal cationic surfactant(s) are present in amounts of at least 200 parts per million (ppm), preferably in amounts of 200 - 700 ppm, more preferably in amounts of from 250 - 500 ppm.

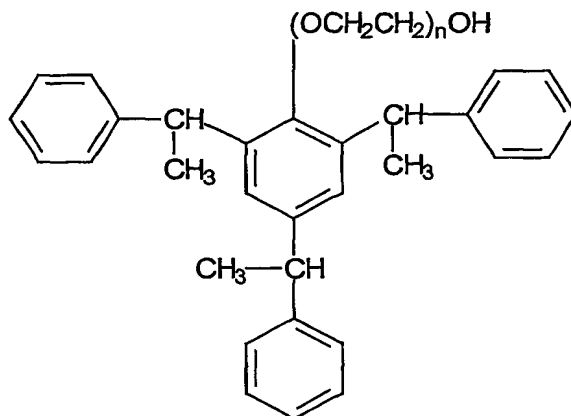
The inventive compositions necessarily include (b) at least one tristyrylphenolethoxylate compound. Particularly useful tristyrylphenolalkoxylate compounds include those which may be represented by the general structure:



wherein:

20 n is a value from 1 - 50; preferably 1 - 40; and,  
X represents one or more alkoxy groups, especially  
one or more C<sub>2</sub>-C<sub>4</sub> alkoxy groups especially ethoxy  
(-OCH<sub>2</sub>CH<sub>2</sub>-) and/or propoxy (-OCH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>-) groups.  
Further representative and particularly preferred are  
tristyrylphenoethoxylates which include those which may

be represented according to the following structural formula:



5

wherein:

$n$  is a value from 1 - 40.

Exemplary commercially available tristyrylphenolethoxylates include SOPROPHOR  
 10 tristyrylphenol ethoxylates (ex. Rhodia Inc., Cranbury, NJ) Examples of such materials include SOPROPHOR BSU, described as having approximately 16 moles of ethoxylation ( $n = 16$ ); SOPROPHOR CY/8, described as having approximately 20 moles of ethoxylation ( $n = 20$ );  
 15 SOPROPHOR S/25, described as having approximately 25 moles of ethoxylation ( $n = 25$ ); as well as SOPROPHOR S/40-P, described as having approximately 40 moles of ethoxylation, ( $n = 40$ ).

Certain exemplary and particularly preferred  
 20 tristyrylphenolethoxylate compounds are described with reference to the Examples described below.

According to the first aspect and second aspects of the invention, the compositions necessarily include (c) one or more surfactants which provide a further deterative

benefit to the compositions, ( but it is to be understood that according to further certain specific particularly embodiments these one or more surfactants are specifically absent.)

5        Useful surfactants which provide a further deterative benefit which may be present in the inventive compositions include deterative surfactants particularly selected from carboxylate, nonionic, cationic and amphoteric surfactants.

10        Suitable nonionic surfactants include, inter alia, condensation products of alkylene oxide groups with an organic hydrophobic compound, such as an aliphatic compound or with an alkyl aromatic compound. The nonionic synthetic organic detergents generally are the  
15        condensation products of an organic aliphatic or alkyl aromatic hydrophobic compound and hydrophilic ethylene oxide groups. Practically any hydrophobic compound having a carboxy, hydroxy, amido, or amino group with a free hydrogen attached to the nitrogen can be condensed  
20        with ethylene oxide or with the polyhydration product thereof, polyethylene glycol, to form a water soluble nonionic detergent. Further, the length of the polyethenoxy hydrophobic and hydrophilic elements may be varied to adjust these properties.

25        One example of such a nonionic surfactant is the condensation product of one mole of an alkyl phenol having an alkyl group containing from 6 to 12 carbon atoms with from about 5 to 25 moles of an alkylene oxide. Another example of such a nonionic surfactant is the  
30        condensation product of one mole of an aliphatic alcohol which may be a primary, secondary or tertiary alcohol having from 6 to 18 carbon atoms with from 1 to about 10

moles of alkylene oxide. Preferred alkylene oxides are ethylene oxides or propylene oxides which may be present singly, or may be both present.

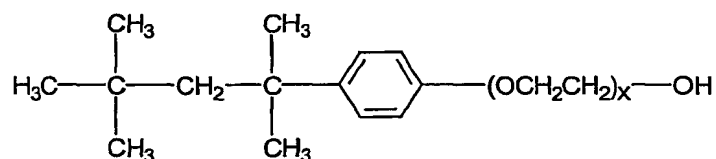
Preferred nonionic surfactants include primary and  
5 secondary linear and branched alcohol ethoxylates, such as those based on C<sub>6</sub>-C<sub>18</sub> alcohols which further include an average of from 2 to 80 moles of ethoxylation per mol of alcohol. Particularly preferred nonionic surfactants are C<sub>11</sub> linear primary alcohol ethoxylates averaging about 9  
10 moles of ethylene oxide per mole of alcohol. These surfactants are available, for example, under the commercial name of Neodol 1-9, (from Shell Chemical Company, Houston, TX) , or in the Genapol® series of linear alcohol ethoxylates, particularly Genapol® 26-L-60  
15 or Genapol® 26-L-80 (from Clariant Corp., Charlotte, NC). A further class of nonionic surfactants which are advantageously present in the inventive compositions are those presently marketed under the Genapol® tradename.

A further particularly useful and preferred alcohol  
20 ethoxylate is Genapol® UD-079 which is described to be a C<sub>11</sub> linear alcohol condensed with 7 moles of ethylene oxide to form a nonionic surfactant.

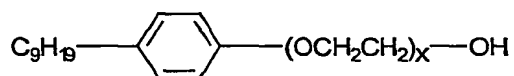
It is to be understood that other nonionic surfactants other than those described above may also be  
25 used. By way of illustration, and not by way of limitation, examples include secondary C<sub>12</sub>-C<sub>15</sub> alcohol ethoxylates, including those which have from about 3 to about 10 moles of ethoxylation. Such are available in the Tergitol® series of nonionic surfactants (Union  
30 Carbide Corp., Danbury, CT), particularly those in the Tergitol® "15-S-" series. Further exemplary nonionic surfactants include linear primary C<sub>11</sub>-C<sub>15</sub> alcohol

ethoxylates, including those which have from about 3 to about 10 moles of ethoxylation. Such are available in the Neodol® series of nonionic surfactants (Shell Chemical Co.)

- 5 A further class of nonionic surfactants which may find use in the present inventive compositions include ethoxylated octyl and nonyl phenols include those having one of the following general structural formulas:



10 or,



in which the  $\text{C}_9\text{H}_{19}$  group in the latter formula is a mixture of branched chained isomers, and x indicates an average number of ethoxy units in the side chain.

- 15 Particularly suitable non-ionic ethoxylated octyl and nonyl phenols include those having from about 7 to about 13 ethoxy groups. Such compounds are commercially available under the trade name Triton® X (Union Carbide, Danbury CT), as well as under the tradename Igepal®  
 20 (Rhodia, Inc., Cranbury, NJ). One exemplary and particularly preferred nonylphenol ethoxylate is Igepal® CO-630.

One useful class of surfactants include amine oxide compounds. Exemplary useful amine oxide compounds may be  
 25 defined as one or more of the following of the four general classes:

- (1) Alkyl di (lower alkyl) amine oxides in which the alkyl group has about 6-24, and preferably 8-18



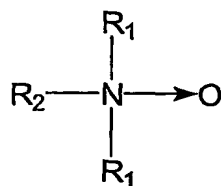
carbon atoms, and can be straight or branched chain, saturated or unsaturated. The lower alkyl groups include between 1 and 7 carbon atoms, but preferably each include 1 - 3 carbon atoms.. Examples include octyl dimethyl amine oxide, lauryl dimethyl amine oxide, myristyl dimethyl amine oxide, and those in which the alkyl group is a mixture of different amine oxides, such as dimethyl cocoamine oxide, dimethyl (hydrogenated tallow) amine oxide, and myristyl/palmityl dimethyl amine oxide;

(2) Alkyl di (hydroxy lower alkyl) amine oxides in which the alkyl group has about 6-22, and preferably 8-18 carbon atoms, and can be straight or branched chain, saturated or unsaturated. Examples include bis-(2-hydroxyethyl) cocoamine oxide, bis-(2-hydroxyethyl) tallowamine oxide; and bis-(2-hydroxyethyl) stearylamine oxide;

(3) Alkylamidopropyl di(lower alkyl) amine oxides in which the alkyl group has about 10-20, and preferably 12-16 carbon atoms, and can be straight or branched chain, saturated or unsaturated. Examples are cocoamidopropyl dimethyl amine oxide and tallowamidopropyl dimethyl amine oxide; and

(4) Alkylmorpholine oxides in which the alkyl group has about 10-20, and preferably 12-16 carbon atoms, and can be straight or branched chain, saturated or unsaturated.

While these amine oxides recited above may be used, preferred are amine oxides which may be represented by the following structural representation:



wherein

each  $R_1$  independently is a straight chained  $C_1$ - $C_4$  alkyl group, preferably both  $R_1$  are methyl groups; and,

5  $R_2$  is a straight chained  $C_6$ - $C_{22}$  alkyl group, preferably is  $C_6$ - $C_{16}$  alkyl group, most preferably is a  $C_8$ -  
10 alkyl group, especially a  $C_8$  alkyl group;

Each of the alkyl groups may be linear or branched, but most preferably are linear. Most preferably the amine  
10 oxide constituent is lauryl dimethyl amine oxide.

Technical grade mixtures of two or more amine oxides may be used, wherein amine oxides of varying chains of the  $R_2$  group are present. Preferably, the amine oxides used in the present invention include  $R_2$  groups which comprise at  
15 least 50%wt., preferably at least 75%wt. of  $C_8$  alkyl group.

Exemplary and preferred amine oxide compounds include N-alkyl dimethyl amine oxides, particularly octyl dimethyl amine oxides as well as lauryl dimethyl amine  
20 oxide. These amine oxide compounds are available as surfactants from McIntyre Group Ltd. under the name Mackamine® C-8 which is described as a 40% by weight active solution of octyl dimethyl amine oxide, as well as from Stepan Co., under the tradename Ammonyx® LO which is  
25 described to be as a 30%wt. active solution of lauryl dimethyl amine oxide.

A further class of materials surfactants which may be advantageously included in the inventive compositions are alkoxy block copolymers, and in particular, compounds

based on ethoxy/propoxy block copolymers. Polymeric alkylene oxide block copolymers include nonionic surfactants in which the major portion of the molecule is made up of block polymeric C<sub>2</sub>-C<sub>4</sub> alkylene oxides. Such  
5 nonionic surfactants, while preferably built up from an alkylene oxide chain starting group, and can have as a starting nucleus almost any active hydrogen containing group including, without limitation, amides, phenols, thiols and secondary alcohols.

10 One group of such useful nonionic surfactants containing the characteristic alkylene oxide blocks are those which may be generally represented by the formula (A) :



15 where EO represents ethylene oxide,  
PO represents propylene oxide,  
y equals at least 15,  
EO)<sub>x+z</sub> equals 20 to 50% of the total weight of said compounds, and,  
20 the total molecular weight is preferably in the range of about 2000 to 15,000.

Another group of nonionic surfactants appropriate for use in the new compositions can be represented by the formula (B) :

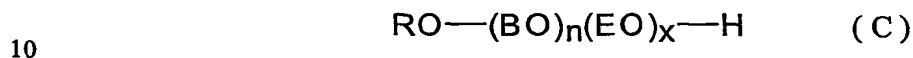


wherein R is an alkyl, aryl or aralkyl group, where the R group contains 1 to 20 carbon atoms, the weight percent of EO is within the range of 0 to 45% in one of the blocks a, b, and within the range of 60 to 100% in the  
30 other of the blocks a, b, and the total number of moles of combined EO and PO is in the range of 6 to 125 moles,

with 1 to 50 moles in the PO rich block and 5 to 100 moles in the EO rich block.

Further nonionic surfactants which in general are encompassed by Formula B include butoxy derivatives of propylene oxide/ethylene oxide block polymers having  
5 molecular weights within the range of about 2000-5000.

Still further useful nonionic surfactants containing polymeric butoxy (BO) groups can be represented by formula (C) as follows:



wherein R is an alkyl group containing 1 to 20 carbon atoms,

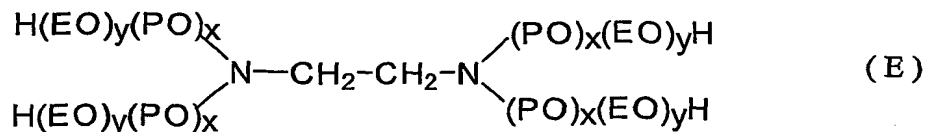
n is about 5-15 and x is about 5-15.

Also useful as the nonionic block copolymer  
15 surfactants, which also include polymeric butoxy groups, are those which may be represented by the following formula (D):



20 wherein n is about 5-15, preferably about 15,  
x is about 5-15, preferably about 15, and  
y is about 5-15, preferably about 15.

Still further useful nonionic block copolymer surfactants include ethoxylated derivatives of propoxylated ethylene diamine, which may be represented  
25 by the following formula:



where (EO) represents ethoxy,  
(PO) represents propoxy,

the amount of  $(PO)_x$  is such as to provide a molecular weight prior to ethoxylation of about 300 to 7500, and the amount of  $(EO)_y$  is such as to provide about 20% to 90% of the total weight of said compound.

5        Of these, the most preferred are those which are represented by formula (A) above; specific examples of which include those materials presently commercially available under the tradename "Pluronic®", and in particular the Pluronic® F series, Pluronic® L series,  
10 Pluronic® P series, as well as in the Pluronic® R series, each of which are generally described to be block copolymers of propylene oxide and ethylene oxide. Generally those of the Pluronic® L series and the Pluronic® R series are preferred as these are supplied in  
15 liquid form by the manufacturer and are readily formulated into the present inventive compositions. These are also available in a wide range of HLB values, and those having HLB values in the range of 1.0 - 23.0 may be used, although those with intermediate HLB values  
20 such as from about 12.0 - 18.0 are found to be particularly advantageous. These materials are presently commercially available from BASF AG (Ludwigshafen, Germany) as well as from BASF Corp. (Mt. Olive Township, New Jersey).

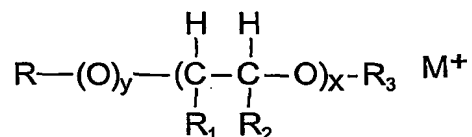
25        A further class of surfactants which may be advantageously included in the inventive compositions are carboxylates, particularly one or more alkylpolyoxycarboxylates including alkyletherpolyoxycarboxylates, or  
30 alkylarylpolycarboxylates. Exemplary alkylpolyoxycarboxylates and alkylarylpolycarboxylates

include alkyl- and alkylaryl-carboxylates which include those which may be represented by the general formula:



wherein R is a straight or branched hydrocarbon chain containing from about 9 to 21 carbon atoms, and which may also include an aromatic ring, especially a phenyl group as part of the hydrocarbon chain, and M is a metal or ammonium ion.

Further examples of particularly useful carboxylate surfactants include compounds according to the formula:

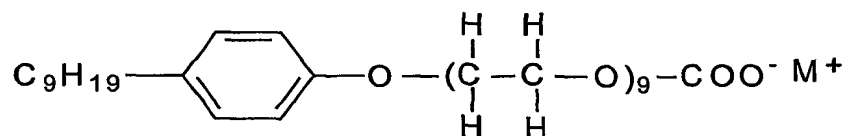


where:

R is a C<sub>4</sub>-C<sub>22</sub> linear or branched alkyl group which may optionally include at least one aryl group, preferably C<sub>8</sub>-C<sub>15</sub> linear or branched alkyl group which may include at least one aryl group, and yet more preferably a C<sub>12-15</sub> linear or branched alkyl group which may include at least one aryl group;  
 x is an integer from 1 to 24,  
 y is 0 or 1,  
 R<sub>1</sub>, R<sub>2</sub> and R<sub>3</sub> are each individually a group selected from H, lower alkyl radicals including methyl and ethyl radicals, carboxylate radicals including acetate and propionate radicals, succinate radicals, hydroxysuccinate radicals, or mixtures thereof wherein at least one R<sub>1</sub>, R<sub>2</sub> or R<sub>3</sub> is a carboxylate radical; and,  
 M<sup>+</sup> is a counterion including an alkali metal counterion (i.e., sodium, potassium) or ammonium counterion.

Free acid forms of the alkylethercarboxylate compounds noted above may also be used.

Examples of such presently available commercial preparations include SURFINE WLG (Finetex Inc., Elmwood Park NJ), SANDOPAN DTC (Clariant Chem.Co., Charlotte NC) in salt forms, and in free acid forms include those marketed under the tradename NEODOX (Shell Chemical Co., Houston TX). One particularly preferred carboxylate is one which is represented by the formula:



Such a material is presently commercially available under the tradename Emcol®, and specifically as Emcol® CNP-110.

Other useful exemplary nonionic block copolymers based on a polymeric ethoxy/propoxy units which may also be used include those presently commercially available in the Poly-Tergent® E, and Poly-Tergent® P series of materials from Olin Chemicals Corp., (Stamford CT). These are described to be nonionic surfactants based on ethoxy/propoxy block copolymers, conveniently available in a liquid form from its supplier.

It is to be understood that these nonionic surfactants based on polymeric alkylene oxide block copolymers may be used singly or in mixtures of two or more such compounds.

Amphoteric surfactants, also known as zwitterionic surfactants, contain both cationic and anionic hydrophilic groups on the same molecule at a relatively wide range of pHs. The typical cationic group is a quaternary ammonium group, although other positively

charged groups, like sulfonium groups, can also be used. The typical anionic hydrophilic groups are carboxylates and sulfonates, although other groups like sulfates, etc., can be used. Amphoteric surfactants also include  
5 betaine and sulphobetaine surfactants, derivatives thereof, and mixtures thereof wherein the molecule contains both basic and acidic groups which form an inner salt giving the molecule both cationic and anionic hydrophilic groups over a broad range of pH values, as  
10 well as mono- and diacetates, glycinate, imidazolines and their derivatives, mono- and dipropionates, hydroxy sultaines, and taurates.

When the compositions of the present invention contain one or more further deterative surfactants, these  
15 may be present in any amount which is found to provide a beneficial deterative effect. Generally, these one or more further deterative surfactants do not comprise more than 12%wt. (on an actives weight basis) of the inventive compositions. When included such one or more further  
20 deterative surfactants are advantageously present in an amount from 0.001 - 10%wt., preferably are present from 0.01 - 8%wt., but still more preferably are included in amounts of from 0.1 - 8%wt.

According to the first aspect and third aspects of  
25 the invention, the compositions necessarily include (d) one or more organic solvents, ( but it is to be understood that according to further certain specific particularly embodiments these one or more organic solvents are specifically absent.)

30 Exemplary organic solvents which may be included in the inventive compositions include those which are at least partially water-miscible such as alcohols (e.g., low



molecular weight alcohols, such as, for example, ethanol, propanol, isopropanol, and the like), glycols (such as, for example, ethylene glycol, propylene glycol, hexylene glycol, and the like), water-miscible ethers (e.g. diethylene glycol diethylether, diethylene glycol dimethylether, propylene glycol dimethylether), water-miscible glycol ether (e.g. propylene glycol monomethylether, propylene glycol monoethylether, propylene glycol monopropylether, propylene glycol monobutylether, ethylene glycol monobutylether, dipropylene glycol monomethylether, dipropylene glycol monopropyl ether, dipropylene glycol monobutyl ether, diethyleneglycol monobutylether), lower esters of monoalkylethers of ethyleneglycol or propylene glycol (e.g. propylene glycol monomethyl ether acetate) all commercially available such as from Union Carbide (Danbury, CT), Dow Chemical Co. (Midland, MI) or Hoescht (Germany). Mixtures of several organic solvents can also be used.

Preferred as solvents in this invention are the glycol ethers having the general structure  $R_a-O-R_b-OH$ , wherein  $R_a$  is an alkyl of 1 to 20 carbon atoms, or an aryl of at least 6 carbon atoms, and  $R_b$  is an alkylene of 1 to 8 carbons, or is an ether or polyether containing from 2 to 20 carbon atoms. Preferred are glycol ethers having one to five glycol monomer units. These are  $C_3-C_{20}$  glycol ethers. Examples of more preferred solvents include propylene glycol methyl ether, dipropylene glycol methyl ether, tripropylene glycol methyl ether, propylene glycol isobutyl ether, ethylene glycol methyl ether, ethylene glycol ethyl ether, ethylene glycol butyl ether,

diethylene glycol phenyl ether, propylene glycol phenol ether, and mixtures thereof.

The compositions are largely aqueous in nature, and comprise as a further necessary constituent (e) water.

5 Water is added to order to provide to 100% by weight of the compositions of the invention. The water may be tap water, but is preferably distilled and is most preferably deionized water. If the water is tap water, it is preferably substantially free of any undesirable  
10 impurities such as organics or inorganics, especially minerals salts which are present in hard water which may thus undesirably interfere with the operation of the constituents present in the aqueous compositions according to the invention.

15 As discussed previously, the inventive compositions may comprise one or more conventional optional additives. By way of non-limiting example, these include: pH adjusting agents and pH buffers including organic and inorganic salts; non-aqueous solvents, perfumes, perfume  
20 carriers, optical brighteners, coloring agents such as dyes and pigments, opacifying agents, hydrotropes, antifoaming agents, viscosity modifying agents such as thickeners, enzymes, anti-spotting agents, anti-oxidants, anti-corrosion agents as well as others not specifically  
25 elucidated here. These ingredients may be present in any combinations and in any suitable amount that is sufficient for imparting the desired properties to the compositions. These one or more conventional additives, when present, should be present in minor amounts,  
30 preferably in total comprise less than about 5% by weight (on an active weight basis) of the compositions, and desirably less than about 3%wt.

Such materials described above are known to the art, including those described in *McCutcheon's Emulsifiers and Detergents* (Vol.1), *McCutcheon's Functional Materials* (Vol. 2), North American Edition, 1998; *Kirk-Othmer, Encyclopedia of Chemical Technology*, 4<sup>th</sup> Ed., Vol. 23, the contents of which are herein incorporated by reference. For any particular composition, any optional constituents should be compatible with the other ingredients present.

The aqueous compositions according to the invention are desirably provided as a ready to use product which may be directly applied to a hard surface. Hard surfaces which are to be particularly denoted are lavatory fixtures, lavatory appliances (toilets, bidets, shower stalls, bathtubs and bathing appliances), wall and flooring surfaces especially those which include refractory materials and the like. Further hard surfaces which are particularly denoted are those associated with kitchen environments and other environments associated with food preparation. Hard surfaces which are those associated with hospital environments, medical laboratories and medical treatment environments. Such hard surfaces described above are to be understood as being recited by way of illustration and not by way of limitation.

The formulations according to the present invention include both cleaning compositions and concentrates as discussed above which only differ in the relative proportion of water to that of the other constituents. The concentrate can be used without dilution (concentrate:water 1:0) to extremely dilute dilutions (e.g., 1:10,000). A preferred range of dilution is from

about 1:1 to about 1:1,000, more preferably from about 1:1 to about 1:500, and more preferably from about 1:10 to about 1:128.

The composition provided according to the invention  
5 can be desirably provided as a ready to use product in a manually operated spray dispensing container, or may be supplied in aerosolized product wherein it is discharged from a pressurized aerosol container. Known art propellants such as liquid propellants based on  
10 chlorofluorocarbons or propellants of the non-liquid form, i.e., pressurized gases, including carbon dioxide, air, nitrogen, as well as others, may be used, even though it is realized that the former chlorofluorocarbons are not generally further used due to environmental  
15 considerations. In such an application, the cleaning composition is dispensed by activating the release nozzle of said aerosol type container onto the stain and/or stain area, and in accordance with a manner as above-described a stain is treated and removed.

20 When supplied as an aerosol, one preferred formulation will have water as a major constituent and other preferred formulations will have an organic solvent, most preferably a low molecular weight alcohol, as the major constituent.

25 The composition according to the invention is ideally suited for use in a consumer "spray and wipe" application. In such an application, the consumer generally applies an effective amount of the cleaning composition using the pump and within a few moments  
30 thereafter, wipes off the treated area with a rag, towel, or sponge, usually a disposable paper towel or sponge. In certain applications, however, especially where

undesirable stain deposits are heavy, the cleaning composition according to the invention may be left on the stained area until it has effectively loosened the stain deposits after which it may then be wiped off, rinsed  
5 off, or otherwise removed. For particularly heavy deposits of such undesired stains, multiple applications may also be used. Where thorough disinfection is a primary consideration, it may be desired to apply the inventive compositions to the hard surface being treated  
10 and to permit the composition to remain on the hard surface for several minutes (2-10 min.) prior to rinsing or wiping the composition from the hard surface. It is also contemplated that the inventive compositions be applied to a hard surface without subsequently wiping or  
15 rinsing the treated hard surface.

Whereas the compositions of the present invention are intended to be used in the types of liquid forms described, nothing in this specification shall be understood as to limit the use of the composition  
20 according to the invention with a further amount of water to form a cleaning solution therefrom. In such a proposed diluted cleaning solution, the greater the proportion of water added to form said cleaning dilution will, the greater may be the reduction of the rate and/or  
25 efficacy of the thus formed cleaning solution.

Accordingly, longer residence times upon the stain to effect their loosening and/or the useage of greater amounts may be necessitated. Conversely, nothing in the specification shall be also understood to limit the  
30 forming of a "super-concentrated" cleaning composition based upon the composition described above. Such a super-concentrated ingredient composition is essentially

the same as the cleaning compositions described above except in that they include a lesser amount of water.

The composition of the present invention, whether as described herein or in a concentrate or super concentrate  
5 form, can also be applied to a hard surface by using a wet wipe. The wipe can be of a woven or non-woven nature. Fabric substrates can include non-woven or woven pouches, sponges, in the form of abrasive or non-abrasive cleaning pads. Such fabrics are known commercially in  
10 this field and are often referred to as wipes. Such substrates can be resin bonded, hydroentangled, thermally bonded, meltblown, needlepunched, or any combination of the former.

The non-woven fabrics may be a combination of wood  
15 pulp fibers and textile length synthetic fibers formed by well known dry-form or wet-lay processes. Synthetic fibers such as rayon, nylon, orlon and polyester as well as blends thereof can be employed. The wood pulp fibers should comprise about 30 to about 60 percent by weight of  
20 the non-woven fabric, preferably about 55 to about 60 percent by weight, the remainder being synthetic fibers. The wood pulp fibers provide for absorbency, abrasion and soil retention whereas the synthetic fibers provide for substrate strength and resiliency.

25 The substrate of the wipe may also be a film forming material such as a water soluble polymer. Such self-supporting film substrates may be sandwiched between layers of fabric substrates and heat sealed to form a useful substrate. The free standing films can be  
30 extruded utilizing standard equipment to devolatilize the blend. Casting technology can be used to form and dry

films or a liquid blend can be saturated into a carrier and then dried in a variety of known methods.

The compositions of the present invention are absorbed onto the wipe to form a saturated wipe. The  
5 wipe can then be sealed individually in a pouch which can then be opened when needed or a multitude of wipes can be placed in a container for use on an as needed basis. The container, when closed, sufficiently sealed to prevent evaporation of any components from the compositions.

10 The following examples below illustrate exemplary and preferred formulations of the concentrate composition according to the instant invention. It is to be understood that these examples are presented by means of illustration only and that further useful formulations  
15 fall within the scope of this invention and the claims may be readily produced by one skilled in the art and not deviate from the scope and spirit of the invention.

Throughout this specification and in the accompanying claims, weight percents of any constituent  
20 are to be understood as the weight percent of the active portion of the referenced constituent, unless otherwise indicated.

#### Examples:

25 The following examples illustrate the formulation and performance of various compositions of the invention, as well as certain particularly preferred embodiments of the invention.

Exemplary formulations illustrating certain  
30 preferred embodiments of the inventive compositions and described in more detail in Table 1 below were formulated generally in accordance with the following protocol. The

weight percentages indicated the "as supplied" weights of the named constituent.

Into a suitably sized vessel, a measured amount of water was provided after which the constituents were added in no specific or uniform sequence, which indicated that the order of addition of the constituents was not critical. All of the constituents were supplied at room temperature, and any remaining amount of water was added thereafter. Certain of the nonionic surfactants if gels at room temperature were first preheated to render them pourable liquids prior to addition and mixing. Mixing of the constituents was achieved by the use of a mechanical stirrer with a small diameter propeller at the end of its rotating shaft. Mixing, which generally lasted from 5 minutes to 120 minutes was maintained until the particular exemplary formulation appeared to be homogeneous. The exemplary compositions were readily pourable, and retained well mixed characteristics (i.e., stable mixtures) upon standing for extend periods. The compositions of the example formulations are listed on Table 1. Certain comparative examples are also described on Table 1; these are identified as "C" followed by an integer number.

TABLE 1					
	<u>C1</u>	<u>C2</u>	<u>Ex.1</u>	<u>Ex.2</u>	<u>Ex. 3</u>
BTC-8358 (80%)	3.6	--	3.6	3.6	0.056
SOPROPHOR BSU (100%)	--	3.2	2.01	3.2	0.05
di water	q.s.	q.s.	q.s.	q.s.	q.s.



As is indicated, to all of the formulations of Table 1 was added sufficient deionized water in "quantum sufficient" to provide 100 parts by weight of a particular formulation.

- 5 The identity of the constituents of used to produce various formulations described herein are disclosed on Table 2, below, including the "actives" percentage of each where a constituent was not 100%wt. "actives".

TABLE 2	
BTC-8358 (80%)	alkyl dimethyl benzyl ammonium chloride (80%wt. actives) from Stepan Co.
SOPROPHOR BSU (100%)	tristyrylphenol ethoxylate, 16 moles of ethoxylation (100%wt. actives) from Rhodia
di water	deionized water

10 Cleaning Efficacy

- Certain of the compositions indicated above were diluted with water at a respective weight ratio of composition:water of 1:64. These diluted compositions were then subjected to the protocol of ASTM D-4488-89
- 15 Annex A5 for particulate soil, which evaluated the efficacy of the cleaning compositions on vinyl tile samples. The soil applied was a particulate soil sample containing natural humus, paraffin oil, used crankcase motor oil, Portland cement, silica, lampblack carbon,
- 20 iron oxide, bandy black clay, stearic acid, and oleic acid. produced according to the protocol. Each of the soiled test vinyl tile samples were placed into the apparatus and the center of each tile was wetted with a 20 milliliter sample of a test formulation and allowed to

stand for 1 minute. When approximately 30 seconds had elapsed, a further 50 milliliter sample was applied to the sponge (water dampened, then wrung to remove excess water) of a Gardner Abrasion Tester apparatus.

5 Thereafter the apparatus was cycled 2, 4, 6, 8 and 10 times, which provided, respectively 4, 8, 12, 16 and 20 strokes of the sponge across the face of each of the vinyl test tiles. The reflectance values of the cleaned samples at 2, 4, 6, 8 and 10 cycles were evaluated  
10 utilizing a Minolta Chroma Meter CF-110, with Data Processor DP-100, which evaluated spectrophotomic characteristics of the sample. These readings are reported on Table 3, following.

Table 3					
Formulation	2 cycles	4 cycles	6 cycles	8 cycles	10 cycles
C1	9.6	18.5	44.9	57.3	51.4
C2	7.6	8.2	10.8	11.7	9.1
C3	34	50.5	68.6	63.4	65.3
Ex. 1	28	67.7	73.3	68.2	67.6
Ex. 2	67.9	67.9	69.1	73.6	74

15

Comparative "C3" was a commercially available cleaning and disinfecting composition, LYSOL Disinfectant Cleaner, "Country Scent" (ex Reckitt & Colman Inc., Wayne, NJ) which was diluted and tested in the manner  
20 described above. The composition of C3 was used as a benchmark for cleaning performance.

With respect to the results reported on Table 3 a value of "100" is indicative of a white (unsoiled) background, and a "0" value is indicative of a black  
25 background. As can be seen from the results of Table 3, the cleaning efficacy of the composition according to the

invention provided superior results or were on parity with those of commercially available cleaning products. Surprisingly as can be gleaned from the results of C1 and particularly with respect to C2 in comparison with the results for Ex. 1 and Ex. 2 the inventive compositions provide unexpectedly superior cleaning particularly at 2, 4 and 6 cycles of the test. Such is unexpected, and is suggestive of a synergistic effect.

#### 10 Antimicrobial Efficacy

Ex. 3 was evaluated for antimicrobial activity using the Biomek® 2000 Laboratory Automation Workstation together with the BioWorks Operating System (available from Beckman Coulter Inc., Fullerton, CA). The organism tested was *Staphylococcus aureus* at a concentration of 9 logs. The Biomek simulates a microbial reduction suspension test. One part of organism suspension (*Staphylococcus aureus*) is added to 9 parts of Ex. 3 in an appropriate container. Deionized water (DI H<sub>2</sub>O) was used as a control. The organism and sample are then mixed thoroughly for 15 seconds. Serial tenfold dilutions are carried out in a neutralizing broth. The diluted samples are then incubated for 24-48 hours at 35-37°C. Thereafter, surviving organisms are quantified and log reduction, as a measurement of organism survivors are calculated as follows:

$$\text{Log Reduction} = (\text{Log Survivors/DI H}_2\text{O Control}) - (\text{Log Survivors/Sample})$$

According to this test, Ex. 3 had a log reduction of 4.2.

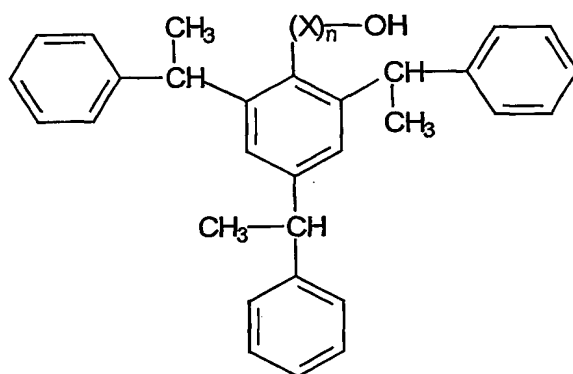
As may be seen from the results indicated above, the compositions according to the invention provide excellent

cleaning benefits to hard surfaces, including hard surfaces with difficult to remove stains notwithstanding the low solids content of the inventive compositions. These advantages are further supplemented by the  
5 excellent antimicrobial efficacy of these compositions against known bacteria commonly found in bathroom, kitchen and other such advantages clearly illustrate the superior characteristics of the compositions, the cleaning and antimicrobial benefits attending its use  
10 which is not before known to the art.

## Claims:

1. A hard surface cleaning and disinfecting composition which comprises:
  - 5 (a) at least one cationic surfactant having germicidal properties;
  - (b) a tristyrylphenolethoxylate compound;
  - (c) optionally, one or more deterative surfactants particularly selected from carboxylate, nonionic,  
10 cationic and amphoteric surfactants;
  - (d) optionally, one or more organic solvents;
  - (e) water.
2. A hard surface cleaning and disinfecting composition  
15 according to claim 1 which is characterized as being essentially free of (d) one or more organic solvents.
3. A hard surface cleaning and disinfecting composition  
20 according to claim 1 which is characterized as being essentially free of (c) one or more deterative surfactants.
4. A hard surface cleaning and disinfecting composition  
25 according to claim 1 which is characterized as being essentially free of both (c) one or more deterative surfactants and (d) one or more organic solvents.
5. A hard surface cleaning and disinfecting composition  
30 according to any preceeding claim wherein the (a) cationic surfactant having germicidal properties is a quaternary ammonium compound.

6. A hard surface cleaning and disinfecting composition according to any preceeding claim wherein the (b) tristyrylphenolalkoxylate compound may be represented by the following structure:



wherein:

- 10         $n$  is a value from 1 - 50; and,  
            $X$  represents one or more alkoxy groups.
7. The composition according to claim 6 wherein  $X$  represents one or more ethoxy  
 15        $(-OCH_2CH_2-)$  and/or propoxy  $(-OCH_2CH_2CH_2-)$  groups.
8. The composition according to claim 7 wherein  $n$  has a value from 1 - 40.
- 20    9. A hard surface cleaning and disinfecting composition according to claim 1, 3 or 5 wherein the (d) one or more organic solvents are selected from: alcohols, ethers glycol ethers, lower esters of monoalkylethers of ethylene glycol or propylene glycol, as well as  
 25       mixtures thereof.

10. A hard surface cleaning and disinfecting composition according to claim 1, 2, or 5 wherein the (c) one or more deterative surfactants are selected from  
5 carboxylate, nonionic, cationic and amphoteric surfactants.
11. A hard surface cleaning and disinfecting composition substantially described with reference to the  
10 Examples.

# INTERNATIONAL SEARCH REPORT

Internal Application No

PCT/GB 03/01727

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 C11D3/00 C11D1/62 C11D3/20 C11D1/38 C11D1/645  
C11D1/65 C11D1/835 C11D1/86 C11D1/94

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, CHEM ABS Data

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 2 336 371 A (RECKITT & COLMAN INC) 20 October 1999 (1999-10-20) claim 1	1-11
A	US 5 856 290 A (KIEWERT EVA ET AL) 5 January 1999 (1999-01-05) claim 1	1
A	US 4 240 918 A (LAGASSE ALAIN ET AL) 23 December 1980 (1980-12-23) claims 1-8	1
A	US 5 154 754 A (DAMO ZOLTAN ET AL) 13 October 1992 (1992-10-13) claim 1	1
	--- -/-	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

\* Special categories of cited documents:

\*A\* document defining the general state of the art which is not considered to be of particular relevance

\*E\* earlier document but published on or after the international filing date

\*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

\*O\* document referring to an oral disclosure, use, exhibition or other means

\*P\* document published prior to the international filing date but later than the priority date claimed

\*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

\*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

\*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

\*G\* document member of the same patent family

Date of the actual completion of the international search

29 July 2003

Date of mailing of the international search report

06/08/2003

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## INTERNATIONAL SEARCH REPORT

Internal Application No

PCT/GB 03/01727

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P, A	US 6 512 034 B1 (HAMADA AKIHIKO ET AL) 28 January 2003 (2003-01-28) claim 1 -----	1

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/GB 03/01727

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